ATMI-579

Section II (Amendment to the Claims)

Please amend claims 1, 2, 3, 5-8, 11, 16-18, 20 and 23 and add new dependent claims 25-29 as set forth in the following listing of claims 1-29.

1. (Currently amended) A sampling system for determining concentration of additives in a metal plating bath solution from an electrochemical processing tool, the system comprising:

a) at least one analysis chamber;

b) a sampling duct comprising a sampling inlet and a first and second sample loop for holding ~~a known amount~~ known amounts of a sample of the plating bath solution, wherein the sampling inlet is in fluid communication with the electrochemical processing tool for receiving a plating bath sample for analysis in the at least one analysis chamber;

c) a four-way valve comprising a connection to a purging ~~fluid~~ gas stream, a connection to the electrochemical processing tool for removal of a sample for analysis, a connection to a waste outlet and a connection to the sampling inlet for movement of the sample into the sampling duct;

d) at least one actuatable multi-port valve positioned in fluid communication with at least one of the sample loops and in fluid communication with the sampling duct;

e) at least one carrier fluid duct in fluid communication with the analysis chamber, wherein the carrier fluid duct and sampling duct are in fluid communication via the actuatable multi-port valve;

f) a flow sensor in fluid communication with the sampling duct and positioned downstream from both of the sample loops, wherein the flow sensor measures a predetermined quantity of plating bath sample flowing through sample duct;

g) a waste drain connected to the sampling duct and positioned downstream of the flow sensor and analysis chamber for removal of analyzed sample from the analysis chamber and excess sample removed from the sample duct; and

h) a purging ~~fluid~~ gas source in fluid communication with the four-way valve for introducing a purging ~~fluid~~ gas ~~source~~ into the sampling duct between successive sample analyses for flushing the sample, the analyzed sample or both from the system, or portions thereof, and into ~~movement through the sample duct to~~ the waste drain.

2. (Currently amended) The system according to claim 1, further comprising a valve control system for controlling the four-way valve to provide a first mode in which the plating bath sample is flowed from the processing tool into the sample duct, a second mode in which the plating bath sample from the processing tool is directed to the waste line, a third mode in which the purge ~~fluid~~ gas ~~source~~ is introduced to the sample duct to purge plating bath sample from the sample duct, and a fourth mode in which the purging ~~fluid~~ gas ~~source or plating bath sample~~ is directed to the waste line without passing through the sample duct or first and second sampling loops ~~loop~~.

3. (Currently amended) The system according to claim 2, wherein the valve control system is communicatively connected to the flow sensor and the four-way valve, wherein the first mode of the four-way valve is turned off when the predetermined quantity of plating bath sample has ~~been~~ flowed ~~through sample duct pass~~ past the flow sensor.

4. (Previously presented) The system according to claim 2, wherein the plating bath sample is purged from the sample duct by actuating the four-way valve and introducing a purging gas into the sample duct.

5. (Currently amended) The system according to claim 2, wherein the at least one actuatable multi-port valve has a first and second position, and wherein the first position provides for the plating bath sample to flow through the sample duct and at least one of the sample loops and the second position provides for flowing the plating bath sample in the sample loop into the carrier fluid duct to the analysis chamber.

6. (Currently amended) The system according to claim 5, wherein the actuatable multi-port valve is in the first position for purging the sample duct with the purging ~~fluid~~ gas source.

7. (Currently amended) The system according to claim 5, wherein the plating bath sample in ~~the~~ at least one of the sample ~~loop~~ loops is flowed into the carrier fluid duct when the multi-port valve is actuated into the second position and the four-way valve is in the third mode wherein the purging ~~fluid~~ gas source is introduced to the sample duct to purge plating bath sample from the sample duct thereby providing for simultaneously purging of the sample duct and analysis of plating bath sample in the analysis chamber.

8. (Currently amended) The system according to claim 1, ~~comprises~~ comprising at least two analysis ~~chamber~~ chambers and two actuatable multi-port valves, one of said chambers and multi-port valves being in fluid contact with the first sample loop and the other chamber and multi-port valve being in fluid contact with the ~~wherein one is positioned in the first and~~ second sample loop.

9. (Previously presented) The system according to claim 1, further comprising reagent containers for holding reagents that are introduced into the at least one analysis chamber.

10. (Previously presented) The system according to claim 1, further comprising reagent containers for holding reagents that are introduced into the at least one analysis chamber and the carrier fluid duct.

11. (Currently amended) The system according to claim 1, wherein ~~the~~ each sample ~~loops contain~~ loop contains from about 1 ml to about 10 ml of plating bath sample.

12. (Previously presented) The system according to claim 1 wherein the first sample loop contains a smaller volume of plating bath sample than the second sample loop and both sample loops fill at approximately the same time.

13. (Previously presented) The system according to claim 12, wherein the smaller fluid amount of plating bath sample is introduced into the analysis chamber from the sample duct through the actuatable multi-port valve and the carrier fluid duct.

14. (Previously presented) The system according to claim 12, further comprising an auxiliary sample duct in fluid communication with the sample duct and analysis chamber, wherein the plating bath sample contained in the second sample loop is introduced into the analysis chamber through the auxiliary sample duct.

15. (Previously presented) The system according to claim 1, further comprising a drain pump in fluid communication with the analysis chamber to drain used analysis solution from the analysis chamber.

16. (Currently amended) The system according to claim ~~15~~ 1, further comprising a liquid transferring system for injecting ~~refilling the analysis chamber with~~ a primary electrolyte ~~after draining used analysis solution from~~ into the analysis chamber.

17. (Currently amended) The system according to claim 16, wherein the transferring system comprises an electrolyte fluid and a ~~means of transferring~~ transfer device adapted to transfer a measured amount of electrolyte ~~for transference~~ to the analysis chamber.

18. (Currently amended) The system according to claim 17, wherein the ~~means for transferring~~ transfer device adapted to transfer a measured amount of the liquid comprises a syringe pump ~~sized to increase transference load of the liquid.~~

19. (Previously presented) The system according to claim 18, wherein the syringe pump comprises:

a) a cylindrical housing sized to transfer at least 10 ml of liquid, wherein the cylindrical housing has an open first end and a closed second end;
b) a cylindrical plunger rod having a first and second end and slidably mounted within the cylindrical housing, wherein the second end of the plunger rod extends through the closed second end of the housing;
c) a tip comprising a body portion having a first and second tip end and a central bore therethrough wherein the first end of the tip is connected to the first end of the cylindrical housing, and wherein the second end has a bore diameter sized to reduce back pressure when filling and reduce the formation of irreproducible droplets at the second end of the tip; and
d) a flexible sealing member connected to the first end of the plunger rod, wherein the flexible sealing member comprises three overlapping radial flaps to form a sealed chamber between the flexible sealing member and the second end of the tip, and wherein the sealed chamber holds a transferable liquid.

20. (Currently amended) A system for determining additives in a metal plating bath in an electrochemical processing tool, the system comprising:

a) at least one analysis chamber;

b) a sampling duct comprising a sampling inlet and ~~a first and second~~ at least one sample loop for holding a known amount of sample positioned upstream from the sample inlet, wherein the sampling duct is in fluid communication with the processing tool for receiving a plating bath sample for analysis in the at least one analysis chamber;

c) an inlet four-way valve positioned before the sampling duct to received the plating bath sample from the electrochemical processing tool and introduce same to the sampling duct;

d) at least one carrier fluid duct in fluid communication with the analysis chamber and sampling duct;

e) at least one actuatable multi-port valve positioned in fluid communication with the at least one ~~of the~~ sample ~~loops~~ loop and in fluid communication with the sampling duct and carrier fluid duct, wherein the at least one actuatable multi-port valve has a first and second position, and wherein the first position provides a flow path for flowing the plating bath sample through the sampling duct and into the at least one sample loop and the second position provides a flow path for flowing the plating bath sample from the at least one sample loop ~~sampling duct~~ to the carrier fluid duct;

f) a flow sensor in fluid communication with the sampling duct and positioned downstream from ~~both of~~ the at least one sample loop ~~loops~~ wherein the flow sensor measures a predetermined quantity of plating bath sample flowing through sample duct and then triggers the actuation of the multi-port valve into the second position;

g) a purging gas source connected to the four-way valve for introducing a purging gas ~~source~~ into the sampling duct to purge ~~previous~~ plating bath sample from the whole or a portion of the system;

h) a waste line in fluid communication with the four-way valve, wherein plating bath solution is transferred from the processing tool through the four-way valve to the waste line; and

i) a valve control system for controlling the inlet four-way valve to provide a first mode in which the plating bath sample is flowed from the processing tool into the sample duct, a second mode in which the plating bath sample from the processing tool is directed to the waste line, a third mode in which the purge gas source is introduced to the sample duct to purge plating bath sample from the sample duct, and a fourth mode in which the purging gas source is directed to the waste line without passing through the sample duct or sampling loops.

21. (Previously presented) The system according to claim 20, which comprises two sample loops, wherein the first sample loop retains a smaller volume of plating bath sample than the second sample loop and both sample loops are filled in the same, filling process.

22. (Previously presented) The system according to claim 21, wherein the plating bath samples in the sample loops are sequentially moved to the analysis chamber via separate flow paths.

23. (Currently amended) The system according to claim 20, wherein analysis of a plating bath sample is conducted simultaneously with the refilling of the at least one sample loop.

24. (Withdrawn) A method for analyzing an analyte in a plating bath sample from an electrochemical deposition solution, the method comprising:

a) providing an analysis system comprising the system according to claim 1;
b) flowing a sufficient amount of a plating bath sample from the electrochemical processing tool through the four-way valve into the sampling duct;
c) stopping the flow of the plating bath sample from the electrochemical processing tool when the flow sensor senses a sufficient amount of sample for testing in the analysis chamber; and
d) actuating the multi-port valve to transfer a predetermined amount of the plating bath sample from the sample duct to the carrier fluid duct for transference into the analysis chamber for analysis therein.

25. (New) The system of claim 1 wherein there is a single actuatable multi-port valve and said single actuatable multi-port valve is in fluid communication with both sample loops and the sampling duct.

26. (New) The sampling system of claim 25 wherein the actuatable multi-port valve has at least two positions, a first position providing for the plating bath sample to flow through the sample duct and the first sample loop and a second position providing for the plating bath sample to flow through the sample duct and the second sample loop.

27. (New) The sampling system of claim 26 wherein when said multi-port valve is in the first position, the second sample loop is in fluid communication with the carrier fluid duct and when said multi-port valve is in the second position, the first sample loop is in fluid communication with the carrier fluid duct.

28. (New) The sampling system of claim 25 wherein the actuatable multi-port valve has four positions, a first position providing for the plating bath sample to flow through the sample duct and the first sample loop, as second position providing for the plating bath sample to flow through the sample duct and the second sample loop, a third position providing for flowing the sample in the first sample loop into the carrier fluid duct to the analysis chamber and a fourth position providing for flowing the sample in the second sample loop into the carrier fluid duct to the analysis chamber.

29. (New) The system of claim 1 comprising two actuatable multi-port valves, one in fluid communication with the sampling duct and the first sample loop and the second in fluid communication with the sampling duct and the second sample loop.